Physics 201, Fall 2018
Problem Set #7 (due Friday, Oct. 26)

Each problem is 10 points.

Problems from Serway, Moses and Moyer:

6.20, 6.21, 6.23, 6.24, 6.37, 7.2, 7.4, 7.5

Additional (required) problems

A1: A particle of mass *m* moves in the harmonic oscillator potential energy $U(x) = \frac{1}{2} m\omega^2 x^2$.

The normalized energy eigenfunctions are denoted by $\psi_n(x)$ and the corresponding energies are $E_n = \hbar\omega\left(n + \frac{1}{2}\right)$, n=1,2,3… Suppose that at time t=0 the wave function of particle is $\psi(x) = \frac{\sqrt{3}}{2}\psi_0(x) + \frac{1-i}{2\sqrt{2}}\psi_1(x)$.

(a) Determine the time dependence of the wave function. That is, what is $\Psi(x,t)$?

(b) What is the probability of obtaining $\hbar\omega/2$ if a measurement of the particle energy is made? Of obtaining $3\hbar\omega/2$? Of obtaining $5\hbar\omega/2$?

Do these probabilities vary with time?

A2. "Solve" the time-independent Schrödinger equation for a particle of mass *m* and energy $E > V_0$ incident from the left on the step potential $V(x) = \begin{cases} V_0 & x < 0 \\ 0 & x > 0 \end{cases}$. Determine the reflection coefficient R and the transmission coefficient T.